PB-239 541

LAKE LAMOILLE, LAMOILLE COUNTY, VERMONT

Pacific Northwest Environmental Research Laboratory

Prepared for:

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Vermont State Agency of Environmental Conservation

July 1974

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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT

ON

LAKE LAMOILLE

LAMOILLE COUNTY

VERMONT

EPA REGION I

WORKING PAPER No. 16

WITH THE COOPERATION OF THE

VERMONT AGENCY OF ENVIRONMENTAL CONSERVATION

AND THE

VERMONT NATIONAL GUARD

JULY, 1974

CONTENTS

	Page
Foreword	ii
List of Vermont Study Lakes	iv
Lake and Drainage Area Maps	v, vi
Sections	
I. Conclusions	1
II. Introduction	3
III. Lake and Drainage Basin Characteristics	4
IV. Lake Water Quality Summary	5
V. Nutrient Loadings	10
VI. Literature Reviewed	17
VII. Appendices	18

FOREWORD

The National Eutrophication Survey was initiated in 1972 as a research project in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations and impact on selected fresh water lakes as a basis for formulating comprehensive and coordinated national, regional and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations and impacts can, in fact, be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

This report documents the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin. It is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/ standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Vermont Agency of Environmental Conservation for professional involvement and to the Vermont National Guard for conduct of the tributary sampling phase of the Survey.

Martin L. Johnson, Secretary of the Vermont Agency of Environmental Conservation; Gordon R. Ryper, Commissioner of the Water Quality Division; David L. Clough, Director, James W. Morse II, Biologist, and Wally McLean, Sanitary Engineer of the Water Quality Division, provided invaluable lake documentation and counsel during the study. Reginald A. LaRosa, Director of the Water Supply and Pollution Control Division, and James F. Agan, Chief of the Operations Section of the Environmental Engineering Division, were most helpful in arranging for the sampling of wastewater treatment plants involved in the Survey.

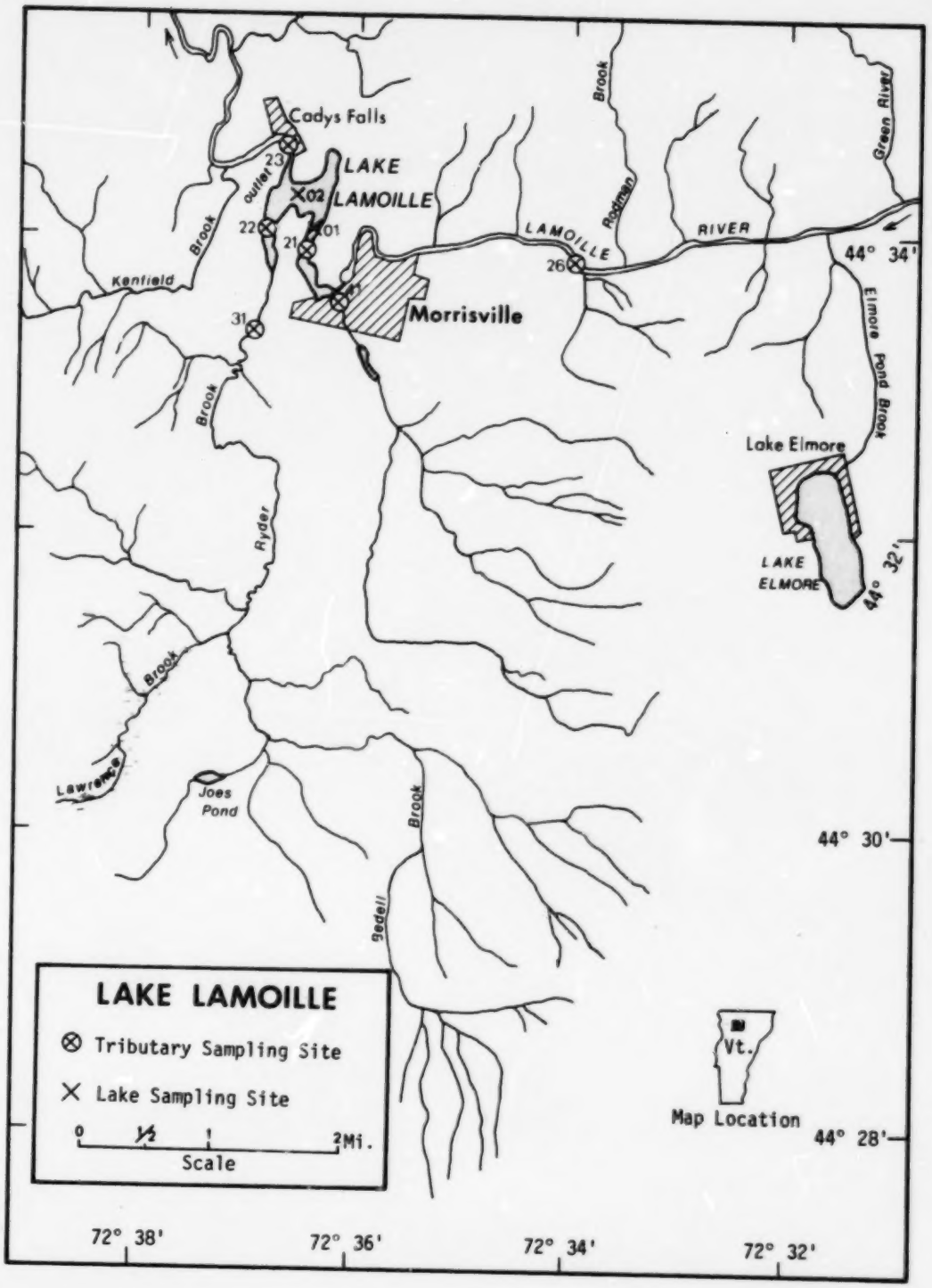
Major General Reginald M. Cram, the Adjutant General of Vermont, and Project Officer Major Howard Buxton, who directed the volunteer efforts of the Vermont National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

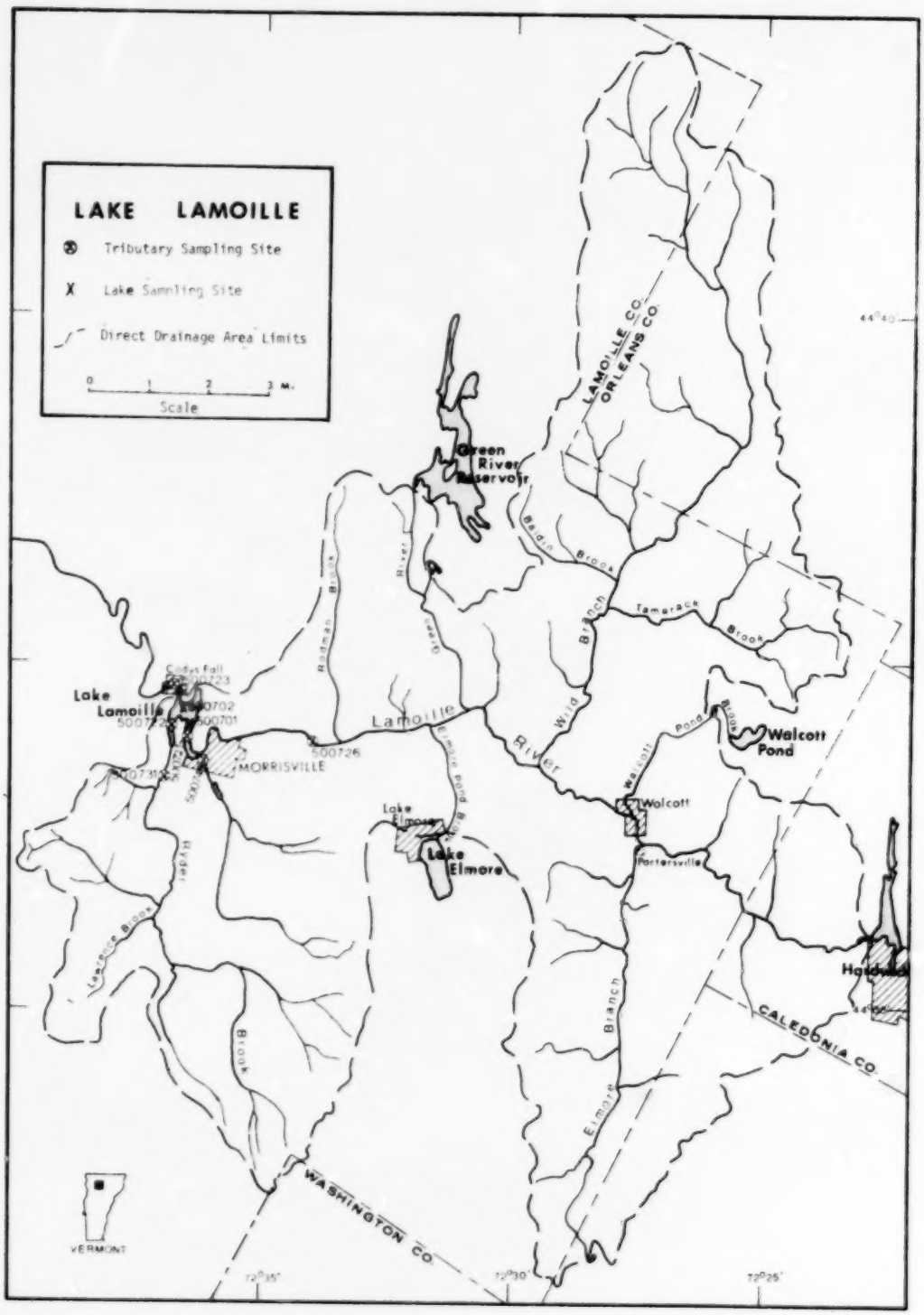
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF VERMONT

LAKE NAME	COUNTY
Arrowhead Mountain Lake	Chittenden, Franklin
Clyde Pond	Orleans
Harriman Reservoir	Windham
Lake Champlain	Addison, Chittenden, Franklin
Lake Lamoille	Lamoille
Lake Memphremagog	Orleans
Waterbury Reservoir	Washington, Lamoille


Cadys Falls
LAKE LAMOILLE
Outlet
Brook
Kenfield
Brook
Ryder
Brook
Brook
Joes Pond
Brook
Sedell
Brook
Rodman
Green River
LAMOILLE
RIVER
Morrisville
Elmore Pond Brook
Lake Elmore
LAKE ELMORE
23
22
21
26
31
X02
X01
44° 34'
44° 32'
44° 30'
44° 28'
72° 38'
72° 36'
72° 34'
72° 32'
LAKE LAMOILLE
Tributary Sampling Site
Lake Sampling Site
0 ½ 1 2Mi.
Scale
Vt.
Map Location


LAKE LAMOILLE
Tributary Sampling Site
Lake Sampling Site
Direct Drainage Area Limits
0 1 2 3 Mi.
Scale
LAMOILLE CO.
ORLEANS CO.
Green River Reservoir
Badgir Brook
Tamarack Brook
Wild Branch
Lamoille River
Rodman Brook
Lake Lamoille
Cady's Falls
500723
500702
500701
500726
MORRISVILLE
Lake Elmore
Elmore Pond Brook
Walcott Pond Brook
Walcott Pond
Walcott
Porterville
Lake Elmore
Hardwick
CALEDONIA CO.
WASHINGTON CO.
Elmore Branch
Lawrence Brook
VERMONT
72°15'
72°30'
72°25'
44°40'

LAKE LAMOILLE

STORET NO. 5007

I. CONCLUSIONS

A. Trophic Condition:

Survey data show that Lake Lamoille is eutrophic. The lake had moderate nutrient and chlorophyll a values and only fair Secchi disc readings. The algal assay test indicated the potential primary productivity in Lake Lamoille was moderately high when sampled, and algal blooms have been noted. During the time of maximum growth, an estimated 20 percent of the lake bottom supported rooted aquatic plants.

The apparent trophic condition of Lake Lamoille is greatly influenced by the very short hydraulic detention time of one day which suppresses the effects of very high nutrient loading rates.

B. Rate-Limiting Nutrient:

The algal assay test indicates the rate-limiting nutrient in Lake Lamoille was phosphorus. Nitrogen-to-phosphorus ratios observed during lake sampling support this conclusion.

C. Nutrient Controllability:

1. Point sources--During the sampling year, Lake Lamoille received a total phosphorus load at a rate more than five times greater than a eutrophic rate (see page 14). Of this load, it is estimated that the villages of Hardwick and Morrisville

contributed about 29%. However, it is calculated that even complete removal of phosphorus at these point sources would still leave a loading rate nearly four times greater than a eutrophic rate, and it is concluded that point-source control would not result in a significant improvement in the trophic condition of Lake Lamoille unless non-point export loads can be reduced.

At this time, construction of secondary treatment facilities at Morrisville has been completed, and plans have been approved for secondary treatment at Hardwick.

2. Non-point sources--The mean non-point phosphorus exports of the streams tributary to Lake Lamoille are somewhat higher than the tributary exports of other Vermont lakes studied (see pages 14 and 15).

The very high export rate of the unnamed brook indicates an urban drainage impact or possibly sewage discharges or septic tank overflows. On the other hand, there are no population centers in the Ryder Brook drainage, and the relatively high phosphorus export rate at least in part is probably due to agricultural practices in the drainage.

The very high drainage area/lake area ratio of 1,121/1 will insure an excessive phosphorus load to Lake Lamoille unless non-point phosphorus sources can be controlled.

II. INTRODUCTION

Lake Lamoille is a relatively small impoundment of the Lamoille River located in Lamoille County just northwest of the village of Morrisville. The lake was formed in 1942 by the construction of a 25-foot head dam by the Morrisville Light Company for the generation of hydroelectric power.

There is practically no development on the shoreline of Lake Lamoille, and the lake has limited recreational use. In a recent report (Anderson, 1971), it is noted that the lake supports very little fishing and that it is a poor fishery resource.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry:

1. Surface area: 153 acres.
2. Mean depth: 5.5 feet.
3. Maximum depth: 21 feet.
4. Volume: 842 acre/feet.
5. Mean hydraulic retention time: 1 day.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area*	Mean flow*
Lamoille River	238.0 mi^2	388.0 cfs
Ryder Brook	18.7 mi^2	30.5 cfs
Unnamed Brook	7.6 mi^2	12.4 cfs
Minor tributaries & immediate drainage -	3.5 mi^2	6.0 cfs
Totals	267.8 mi^2	436.9 cfs

2. Outlet -

Lamoille River	268.0 mi^2**	436.9 cfs

C. Precipitation†:

1. Year of sampling: 52.2 inches.
2. Mean annual: 41.2 inches.

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* Drainage areas are accurate within ±1%; gaged flows are accurate within ±15%, and ungaged flows are accurate within ±20%.
** Includes area of lake.
† See Working Paper No. 1, "Survey Methods".

IV. LAKE WATER QUALITY SUMMARY

Lake Lamoille was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two stations on the lake and from two or more depths at each station (see map, page v). During each visit, a single depth-integrated (near bottom to surface) sample was collected from the stations for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was collected for algal assays (this sample was lost in shipment; and in May, 1973, personnel of the Vermont Department of Water Resources collected a similar sample for algal assays). Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. Maximum depths sampled were 5 feet at station 1 and 18 feet at station 2.

The results obtained are presented in full in Appendix B; and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on aall values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (10/05/72)		
Temperature (Cent.)	11.1	12.1	11.5	13.5
Dissolved oxygen (mg/l)	9.6	9.9	9.8	10.2
Conductivity (μmhos)	128	135	138	140
pH (units)	7.0	7.2	7.1	7.3
Alkalinity (mg/l)	38	40	41	41
Total P (mg/l)	0.013	0.019	0.019	0.026
Dissolved P (mg/l)	0.007	0.009	0.009	0.010
NO_2 + NO_3 (mg/l)	0.210	0.230	0.230	0.250
Ammonia (mg/l)	0.040	0.060	0.060	0.080
		ALL VALUES		
Secchi disc (inches)	46	59	57	72

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
06/02/72	1. Fragilaria	940
	2. Synedra	886
	3. Cymbella	705
	4. Dinobryon	579
	5. Navicula	217
	Other genera	470
	Total	3,797
08/02/72	1. Dinobryon	1,320
	2. Anabaena	1,085
	3. Navicula	597
	4. Cymbella	452
	5. Polycystis	325
	Other genera	1,429
	Total	5,208

Sampling Date	Dominant Genera	Number per ml
10/05/72	1. Dinobryon	1,262
	2. Achnanthes	565
	3. Cymbella	471
	4. Flagellates	414
	5. Fragilaria	301
	Other genera	2,015
	Total	5,028

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
06/02/72	01	6.2
	02	not done
08/02/72	01	3.0
	02	6.6
10/05/72	01	1.0
	02	0.9

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)	N/P Ratio
Control	0.014	0.500	1.9	36/1
0.010 P	0.024	0.500	5.8	21/1
0.020 P	0.034	0.500	8.0	15/1
0.050 P	0.064	0.500	9.9	8/1
0.050 P + 5.0 N	0.064	5.500	19.9	-
0.050 P + 10.0 N	0.064	10.500	22.3	-
10.0 N	0.014	10.500	1.5	-

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Lake Lamoille was moderately high at the time the sample was collected. Also, the increased yields with increased levels of orthophosphorus (to about 36 µg/l--an N/P ratio of 14/1) indicates that the lake was phosphorus limited. Note that the addition of only nitrgen resulted in a yield not significantly different than the control yield.

The lake data indicate phosphorus limitation in June and August as well (N/P ratios were 19/1 and 20/1, respectively, and phosphorus limitation would be expected).

D. Trophic Condition:

Survey data and the records of others show that Lake Lamoille is eutrophic. Chlorophyll a values were moderate, Secchi disc readings were only fair, nutrient concentrations were moderate, and the algal assay indicated a moderately high potential for primary production (the mean hydraulic retention time of the lake is a very short one day; this accounts for the moderate nutrient concentrations in spite of very high nutrient loading rates).

Survey limnologists observed an algal bloom in progress in August, 1972, and noted that aquatic vegetation was common in the shallow areas of the lake.

Survey sampling at depth was somewhat limited, but some depression of dissolved oxygen occurred at station 2 in July, 1972. However, in another study (Anderson, 1971), marked dissolved oxygen depression with depth (to 3.8 mg/l at 20 feet) was observed.

V. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the Vermont National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vi), except for the high runoff months of April and May when two samples were collected. Sampling was begun in July, 1972, and was completed in June, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the New England District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of the U.S. Geological Survey computer program for calculating stream loadings ("STATPAC")*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated by using the nutrient loads, in lbs/mi^2/year, in Ryder Brook at station 31 and multiplying by the ZZ area in mi^2.

The villages of Hardwick and Morrisville did not participate in the Survey, and nutrient loads were estimated*.

The Village of Hardwick is about 16 stream miles above Lake Lamoille, and Hardwick Lake and two small impoundments intervene. Consequently, in this report, it is assumed that 50% of the estimated total phosphorus

* See Working Paper No. 1, "Survey Methods".

load and 10% of the estimated total nitrogen load from Hardwick were sedimented and/or biologically assimilated in the intervening waters during the sampling year. In the following tables, the nutrient loads attributed to the Lamoille River are those measured at station 26 minus the estimated Hardwick loads.

A. Waste Sources:

1. Known municipal -

Name	Pop.* Served	Treatment	Mean* Flow (mgd)	Receiving Water
Hardwick	1,503	None	0.150	Lamoille River & Cooper Brook
Morrisville	2,116	None	0.212	Lake Lamoille

2. Known industrial - None

* Estimated; see Working Paper No. 1, "Survey Methods".

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Lamoille River	20,230	58.8
Ryder Brook	1,810	5.3
Unnamed Brook	1,970	5.7
b. Minor tributaries & immediate drainage (non-point load) -	340	1.0
c. Known municipal -		
Hardwick	2,630	7.6
Morrisville	7,410	21.5
d. Septic tanks - None known	-	-
e. Known industrial - None	-	-
f. Direct precipitation* -	20	<0.1
Total	34,410	100.0

2. Outputs -

Lake outlet - Lamoille River 27,390

3. Net annual P accumulation - 7,020 pounds

* Estimated; see Working Paper No. 1, "Survey Methods".

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Lamoille River	549,880	78.2
Ryder Brook	71,600	10.2
Unnamed Brook	34,550	4.9
b. Minor tributaries & immediate drainage (non-point load) -	13,400	1.9
c. Known municipal -		
Hardwick	12,720	1.8
Morrisville	19,890	2.8
d. Septic tanks - None known	-	-
e. Known industrial - None	-	-
f. Direct precipitation* -	1,470	0.2
Total	703,510	100.0

2. Outputs -

Lake outlet - Lamoille River 667,070

3. Net annual N accumulation - 36,440 pounds

* Estimated; see Working Paper No. 1, "Survey Methods".

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr
Lamoille River	85	2,310
Ryder Brook	97	3,829
Unnamed Brook	259	4,550

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (1973). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	224.9	45.9	4,598.1	238.2
grams/m^2/yr	25.21	5.14	515.4	26.7

Vollenweider loading rates for phosphorus (g/m^2/yr) based on mean depth and mean hydraulic retention time of Lake Lamoille:

"Dangerous" (eutrophic rate)	4.60
"Permissible" (oligotrophic rate)	2.30

F. Nutrient Controllability:

1. Point sources--During the sampling year, Lake Lamoille received a total phosphorus load at a rate more than five times that proposed by Vollenweider as dangerous (i.e., a eutrophic rate). Of this load, it is calculated that the villages of Hardwick and Morrisville contributed about 29%.

It is estimated that even 100% phosphorus removal at the above sources would still leave a loading rate in excess of 158 lbs/acre/yr or 17.8 $g/m^2/yr$ (nearly four times greater than the eutrophic rate). Therefore, it is concluded that phosphorus control at the villages of Hardwick and Morrisville would not result in a significant improvement in the trophic condition of Lake Lamoille.

At the time of preparation of this report, construction of secondary wastewater treatment facilities at the Village of Morrisville has been completed, and plans for the construction of secondary facilities at the Village of Hardwick have been approved.

2. Non-point sources--The mean non-point phosphorus exports of the streams tributary to Lake Lamoille were somewhat higher than the tributary exports of other Vermont lakes studied (mean = 52 $lbs/mi^2/yr$; range 30-65 $lbs/mi^2/yr$).

The unnamed brook had a mean phosphorus export about three times the exports of the Lamoille River and Ryder Brook (see page 14). The lower portion of the brook flows through the Village of

Morrisville, and the high phosphorus load may have been due to urban drainage (storm drains and/or street drainage) but is indicative of sewage discharges or septic tank overflows to the brook.

The Ryder Brook drainage has no population centers, and the relatively high phosphorus export rate at least in part reflects the agricultural practices in the drainage.

It appears that the very high drainage area/lake area ratio of 1,121/1 will insure an excessive phosphorus load to Lake Lamoille unless non-point phosphorus sources are amenable to control. It is calculated that the phosphorus export of the Lamoille River alone would result in a loading rate to the lake of more than 130 lbs/acre/yr or nearly 15 $g/m^2/yr$ (more than three times the eutrophic rate).

VI. LITERATURE REVIEWED

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Farnum, Will, 1973. Personal communication (status of Morse Dairy, Morrisville). VT Dept. Water Resources, Montpelier.

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TRIBUTARY FLOW INFORMATION FOR VERMONT 7/9/74

LAKE CODE 5007 LAKE LAMOILLE

TOTAL DRAINAGE AREA OF LAKE 268.00

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
500727	3.66	4.03	3.37	7.83	19.90	9.11	4.68	2.94	2.61	2.87	4.03	5.56	4.65	5.96
500723	268.00	295.00	247.00	574.00	1461.00	667.00	343.00	215.00	191.00	210.00	295.00	407.00	340.00	436.80
500726	238.00	262.00	219.00	509.00	1297.00	593.00	305.00	191.00	170.00	187.00	262.00	362.00	302.00	388.00
500731	18.70	20.60	17.20	40.00	102.00	46.60	23.90	15.00	13.40	14.70	20.60	28.40	23.70	30.49
500741	7.64	8.40	7.03	16.30	41.60	19.00	9.78	6.13	5.45	6.00	8.40	11.60	9.70	12.44

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 268.00
SUM OF SUB-DRAINAGE AREAS = 268.00
TOTAL FLOW IN = 5246.04
TOTAL FLOW OUT = 5245.00

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
500727	7	72	6.26						
	8	72	3.00						
	9	72	1.77						
	10	72	3.65						
	11	72	6.73						
	12	72	6.09						
	1	73	7.70						
	2	73	5.90						
	3	73	16.40						
	4	73	18.00						
	5	73	14.90						
	6	73	15.90						
500723	7	72	458.00	15	241.00				
	8	72	220.00	12	192.00				
	9	72	130.00	10	101.00				
	10	72	267.00	15	258.00				
	11	72	492.00	5	314.00				
	12	72	445.00	3	267.00				
	1	73	563.00	6	397.00				
	2	73	432.00	3	691.00				
	3	73	205.00	3	389.00				
	4	73	1322.00	8	1115.00	21	1150.00		
	5	73	1094.00	5	1107.00	20	785.00		
	6	73	1163.00	24	1029.00				

TRIBUTARY FLOW INFORMATION FOR VERMONT

7/9/14

LAKE CODE 5007 LAKE LAMOILLE

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
500725	7	72	407.00	15	214.00				
	8	72	196.00	12	170.00				
	9	72	115.00	10	89.70				
	10	72	237.00	15	229.00				
	11	72	433.00	5	278.00				
	12	72	396.00	3	237.00				
	1	73	500.00	6	352.00				
	2	73	343.00	3	614.00				
	3	73	1069.00	3	345.00				
	4	73	1174.00	8	990.00	21	1021.00		
	5	73	473.00	5	983.00	20	697.00		
	6	73	1034.00	24	914.00				
500731	7	72	32.00	15	15.80				
	8	72	15.40	12	13.40				
	9	72	9.07	10	7.05				
	10	72	18.70	15	18.00				
	11	72	34.40	5	21.90				
	12	72	31.00	3	15.60				
	1	73	39.30	6	27.70				
	2	73	30.10	3	46.20				
	3	73	84.00	3	27.10				
	4	73	92.30	8	77.80	21	80.20		
	5	73	76.40	5	77.20	20	54.80		
	6	73	81.00	24	71.80				
500741	7	72	13.10	15	6.88				
	8	72	6.27	12	5.47				
	9	72	3.70	10	2.88				
	10	72	7.61	15	7.34				
	11	72	14.00	5	8.94				
	12	72	12.70	3	7.62				
	1	73	16.00	6	11.30				
	2	73	12.30	3	19.70				
	3	73	34.20	3	11.10				
	4	73	37.60	8	31.80	21	32.80		
	5	73	31.20	5	31.60	20	22.40		
	6	73	33.20	24	29.30				

APPENDIX B

PHYSICAL and CHEMICAL DATA

K - Value is less than indicated
J - Value known to be in error

STORET RETRIEVAL DATE 74/07/02

500701
44 34 00.0 072 36 26.0
LAMOILLE LAKE
50 VERMONT

11EPALES 2111202
3 0005 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/02	14 36	0000	14.7	9.4	60	120	7.60	40	0.150	0.010	0.018	0.012
	14 36	0005	14.0	10.2		130	7.65	45	0.150	0.010	0.018	0.012
72/08/02	18 40	0000			48	160	7.70	59	0.200	0.060	0.032	0.018
	18 40	0004	19.3	9.5		160	7.70	59	0.190	0.060	0.026	0.016
72/10/05	13 30	0000			72	128	7.15	38	0.210	0.050	0.016	0.008
	13 30	0004	11.5	9.8		128	7.15	40	0.220	0.070	0.013	0.007

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/02	14 36	0000	6.2J
72/08/02	18 40	0000	3.0J
72/10/05	13 30	0000	1.0J

STORET RETRIEVAL DATE 74/07/02

500702
44 34 24.0 072 36 42.0
LAMOILLE LAKE
50 VERMONT

11EPALES
3

2111202
0018 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00665 PHOS-DIS MG/L P
72/06/02	14 55	0000	17.6	8.8	54	160	7.80	48	0.140	0.040	0.012	0.008
	14 55	0018	16.6	8.8		140	7.70	50	0.140	0.050	0.023	0.008
72/07/31	18 50	0000			46	150	8.10	47	0.140	0.060	0.017	0.010
	18 50	0004	21.5	9.6		150	7.70	49	0.140	0.070	0.019	0.010
	18 50	0011	20.0	7.6		155	7.60	49	0.240	0.110	0.017	0.010
72/10/05	13 50	0000			72	140	7.30	41	0.250	0.060	0.020	0.010
	13 50	0004	13.5	10.2		138	7.30	41	0.240	0.040	0.019	0.009
	13 50	0014	11.1	9.6		140	7.05	41	0.230	0.040	0.026	0.010

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/07/31	18 50	0000	6.6J
72/10/05	13 50	0000	0.9J

APPENDIX C

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

K - Value is less than indicated
J - Value known to be in error

STORET RETRIEVAL DATE 74/07/02

500721 LS500721
44 33 30.0 072 37 00.0
EAST BRANCH (LAMOILLE R)
50 15/HYDE PARK
I/LAKE LAMOILLE
THIRD BRIDGE WEST OF MORRISVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/07/15	11 30		0.236	0.500	0.024	0.007	0.035
72/08/12	09 15		0.290	0.870	0.075	0.018	0.085
72/09/10	08 17		0.170	0.850	0.080	0.013	0.062
72/10/15	08 20		0.310	0.350	0.100	0.007	0.033
72/11/05	09 35		0.220	0.600	0.063	0.006	0.023
72/12/03	09 05		0.680	0.480	0.040	0.011	0.048
73/02/03	09 00		0.830	0.660	0.240		0.006
73/04/08	12 40		0.570	0.630	0.160	0.011	0.030
73/04/21	13 35		0.520	0.370	0.040	0.007	0.020
73/05/05	15 15		0.240	0.540	0.072	0.014	0.060
73/05/05			0.231	0.350	0.034	0.006	0.020
73/06/24	12 35		0.170	0.560	0.066	0.005K	0.045

STORET RETRIEVAL DATE 74/07/02

500722 LS500722
44 33 30.0 072 37 30.0
WEST BRANCH (LAMOILLE R)
50 15/HYDE PARK
I/LAKE LAMOILLE
BRIDGE W OF MORRISVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/07/15			0.143	0.687	0.041	0.013	0.036
72/08/12	09 55		0.156	0.390	0.040	0.012	0.025
72/09/10	08 35		0.299	0.500	0.075	0.019	0.036
72/10/15	09 15		0.300	0.350	0.100	0.006	0.025
72/11/05	09 30		0.560	0.520	0.084	0.006	0.024
72/12/03	11 05		0.336	0.710	0.025	0.010	0.042
73/02/03	09 15		0.430	0.520	0.220	0.007	0.010
73/04/08	12 45		0.340	0.280	0.040	0.010	0.020
73/04/21	13 45		0.250	0.480	0.063	0.007	0.025
73/05/05	15 25		0.198	0.320	0.023	0.006	0.025
73/05/20	11 20		0.168	0.310	0.014	0.006	0.020
73/06/24	12 55		0.460	0.540	0.088	0.006	0.035

STORET RETRIEVAL DATE 74/07/02

500723 LS500723
44 34 30.0 072 37 30.0
LAMOILLE RIVER MAIN STREAM
50 15/HYDE PARK
0/LAKE LAMOILLE
HWY BRIDGE IN CADYS FALLS
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/07/15	10 00		0.104	0.675	0.057	0.012	0.051
72/08/12	09 05		0.185	0.920	0.059	0.012	0.050
72/09/10	08 25		0.200	0.500	0.085	0.011	0.046
72/10/15	08 25		0.260	0.300	0.110	0.008	0.032
72/11/05	10 00		0.210	0.340	0.063	0.008	0.028
72/12/03	08 35		0.320	0.310	0.026	0.010	0.019
73/01/06	09 25		0.690	0.500	0.054	0.009	0.030
73/02/03	09 45		0.399	0.580	0.176	0.007	0.010
73/03/03	09 10		0.420	0.380	0.147	0.009	0.030
73/04/08	12 35		0.340	0.690	0.160	0.010	0.020
73/04/21	13 40		0.250	0.480	0.056	0.007	0.030
73/05/05	14 55		0.189	0.420	0.039	0.005K	0.035
73/05/20	11 10		0.176	0.355	0.022	0.006	0.020
73/06/24	12 46		0.160	0.500	0.044	0.005K	0.045

STORET RETRIEVAL DATE 74/07/02

500726 LS500726
44 33 25.0 072 34 00.0
LAMOILLE RIVER MAIN STREAM
50 15/HYDE PARK
I/LAKE LAMOILLE
ST RT 15A BRIDGE E OF MORRISVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/08/12	09 30		0.130	1.230	0.034	0.005K	0.020
72/09/10	08 50		0.240	0.375	0.042	0.009	0.019
72/10/15	08 50		0.280	0.250	0.088	0.005K	0.016
72/11/05	09 00		0.211	0.840	0.083	0.009	0.085
72/12/03	08 05		0.294	0.280	0.012	0.006	0.006
73/02/03	08 25		0.390	0.305	0.048	0.009	0.065
73/03/03	08 05		0.378			0.007	0.030
73/04/08	12 30		0.330	0.520	0.081	0.014	0.015
73/04/21	13 25		0.240	0.580	0.120	0.007	
73/05/05	14 45		0.180	0.290	0.015	0.005K	0.020
73/05/20	11 00		0.147	0.300	0.008	0.005K	0.015
73/06/24	12 10		0.160	0.480	0.039	0.005K	0.035

STORET RETRIEVAL DATE 74/07/02

500731 LS500731
44 33 00.0 072 37 30.0
RYDER BROOK
50 15/HYDE PARK
T/LAKE LAMOILLE
1ST CONCRETE BRIDGE ABOVE MOUTH
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/07/15			0.813	1.550	0.044	0.018	0.037
72/08/12	09 45		0.447	0.915	0.075	0.015	0.041
72/09/10	08 15		0.950	0.300	0.056	0.015	0.027
72/10/15	08 05		0.600	0.950	0.087	0.008	0.048
72/11/05	09 20		0.590	0.300	0.058	0.007	0.025
72/12/03	09 30		0.610	0.400	0.028	0.008	0.014
73/01/06	08 45		0.370	0.260	0.042	0.009	0.020
73/02/03			0.790	0.340	0.069	0.006	0.050
73/03/03	08 45		0.990	0.390	0.189	0.006	0.040
73/04/08	12 48		0.550	0.500	0.063	0.018	0.020
73/04/21	14 05		0.520	0.500	0.031	0.007	0.020
73/05/05	15 10		0.410	0.340	0.021	0.005K	0.025
73/05/20	11 40		0.410	0.500	0.056	0.006	0.015
73/06/24	13 05		0.460	0.600	0.067	0.005K	0.035

STORET RETRIEVAL DATE 74/07/02

500741 LS500741
44 33 00.0 072 36 30.0
NO NAME
50 15/HYDE PARK
T/LAKE LAMOILLE
ST RT 100 BRIDGE S OF MORRISVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/07/15	09 55		0.563	1.150	0.088	0.082	0.170
72/08/12	08 50		0.475	1.150	0.145	0.040	0.146
72/09/10	08 04		0.930	0.750	0.231	0.048	0.110
72/10/15	08 00		0.600	0.650	0.140	0.022	0.069
72/11/05	09 10		0.672	0.630	0.147	0.027	0.065
72/12/03	09 41		0.780	0.640	0.069	0.024	0.058
73/01/06	08 35		0.820	0.460	0.080	0.021	0.055
73/02/03	08 45		0.830	0.950	0.115	0.021	0.125
73/03/03	08 30		1.100	0.760	0.273	0.044	0.100
73/04/08	12 50		0.650	0.690	0.147	0.021	0.045
73/04/21	13 55		0.560	0.420	0.063	0.015	0.035
73/05/05	15 00		0.520	0.380	0.058	0.013	0.035
73/05/20	11 33		0.510	0.390	0.038	0.013	0.035
73/06/24	13 12		0.420	1.130	0.440	0.011	0.060